AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.4.2.4

The pH scale and neutralisation

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**32**
Available paper years	**2008–2025**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.4.2.4 The pH scale and neutralisation

Answer 01 · Mark scheme

Question 3

question	answers	extra information	mark
(a)	gives out (heat)		1
(b)	D		1
(c)	L		1
(d)	magnesium chloride		1
total			4

4.4.2.4 The pH scale and neutralisation

Answer 01 · Mark scheme January 2008 | CHY2F | Original Q3 | Legacy

CHY2F

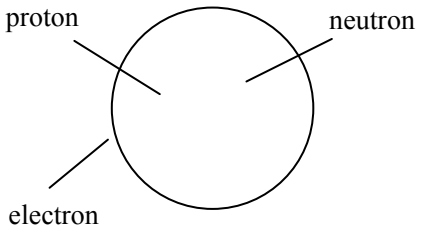
Answer 02 · Mark scheme June 2008 | CHY2F | Original Q1 | Legacy

question	answers	extra information	mark
1(a)(i)	(phosphoric) acid	allow phosphoric acid	1
1(a)(ii)	hydrogen		1
1(b)(i)	faster / quicker / speeds it up (owtte)	allow answers based on activation energy ignore helps it to react	1
1(b)(ii)	most of the starting materials end up as useful products		1
1(b)(iii)	H_2O	allow HOH **or** OH_2	1
Total			**5**

4.4.2.4 The pH scale and neutralisation

Answer 03 · Mark scheme

June 2008 | CHY2F | Original Q5 | Legacy

question	answers	extra information	mark
5(a)(i)		all three correct **2** marks one correct **1** mark	2
5(a)(ii)	14		1
5(b)	A		1
5(c)(i)	ammonia can break up to form nitrogen and hydrogen ammonia is made from nitrogen and hydrogen	list principle applies	2
5(c)(ii)	air		1
5(d)	ammonium nitrate		1
Total			**8**

4.4.2.4 The pH scale and neutralisation

Answer 03 · Mark scheme

June 2008 | CHY2F | Original Q5 | Legacy

COMPONENT NUMBER: CHY2F

COMPONENT NAME: Additional Science / Chemistry

STATUS: Final

DATE: June 2008

4.4.2.4 The pH scale and neutralisation

Answer 04 · Mark scheme

question	answers	extra information	mark
6(a)(i)	hydrogen / H^+ / H^+ (aq)	allow H_3O^+ (aq) ignore H alone	1
6(a)(ii)	any valid test linked comparison eg magnesium **or** any (named) carbonate any **one** from: • weak(er) acid: slower rate / fewer bubbles **or** less gas • weak(er) acid longer for Mg to disappear **or** UI **or** pH paper / solution / meter / full range indicator (1) any **one** from: (1) • weak(er) acid has higher pH • correct comparison of colours **or** conductivity test (1) weak acid conducts less **or** bulb less bright (1)	 **NB** titration = 0 allow zinc / iron do **not** allow calcium **or** alkali metals independent mark allow converse for strong(er) **not** litmus **or** any other paper independent mark allow converse for strong(er) acid pH values must be below 7 ie strong = red / pink weak = orange / yellow allow converse for stronger	1 1

Question 6 continued on next page...

4.4.2.4 The pH scale and neutralisation

Answer 04 · Mark scheme

June 2008 | CHY3F | Original Q6 | Legacy

COMPONENT NUMBER: CHY3F

COMPONENT NAME: Chemistry

STATUS: Final

DATE: June 2008

Question 6 continued...

question	answers	extra information	mark
6(b)(i)	any **two** from eg: • nicotine kills people • nicotine causes cancer / diseases • nicotine is harmful / dangerous • nicotine is addictive • cost to NHS	any plausible answer allow it would save lives allow it kills people ignore references to pollution / passive smoking	2
6(b)(ii)	any **two** from eg: • nicotinic acid / vitamin B3 / niacin has different properties to nicotine • it is in many / listed foods **or** nicotine in food is not dangerous • more health risks to people / pellagra / diarrhoea / dermatitis / dementia / it will cause deaths or save lives • it is a vitamin **or** important part of diet • tobacco raises money / taxes • human rights issues • can't give up straight away / are addicted to it **or** perceived benefit of smoking	any sensible answer ignore if you ban nicotine, nicotinic acid cannot be made ignore malnutrition ignore just 'illness'	2
Total			**7**

4.4.2.4 The pH scale and neutralisation

Answer 04 · Mark scheme June 2008 | CHY3F | Original Q6 | Legacy

COMPONENT NUMBER: CHY3F

COMPONENT NAME: Chemistry

STATUS: Final

DATE: June 2008

Answer 05 · Mark scheme January 2010 | CHY2F | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)	fertilisers		1
2(b)	air		1
2(c)(i)	water **and** carbon monoxide on correct side of equation	accept H_2O for water and CO for carbon monoxide	1
2(c)(ii)	speeds up the reaction (owtte)	accept lowers the activation energy	1
2(d)	reversible reaction		1
2(e)(i)	10		1
2(e)(ii)	sulfuric water	accept H_2SO_4 accept H_2O / hydrogen oxide	1 1
Total			**8**

4.4.2.4 The pH scale and neutralisation

Answer 05 · Mark scheme

January 2010 | CHY2F | Original Q2 | Legacy

CHY2F

4.4.2.4 The pH scale and neutralisation

Answer 06 · Mark scheme

June 2019 | CHY3F | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a)(i)	H^+		1
1(a)(ii)	OH^-		1
1(a)(iii)	lower than		1
1(b)	with HCl: UI goes red / pink has a pH 0 ,1 ,2 **or** 3 **or** with ethanoic acid: UI goes orange / yellow (1) has a pH 4 / or above (but less than 7) (1)	 allow a comparison eg redder than ethanoic acid allow a comparison eg has pH less than ethanoic acid. do **not** accept an incorrect pH. allow a comparison with HCl allow a comparison with HCl	 1 1
1(c)	completely		1
1(d)(i)	conical flask		1
1(d)(ii)	titration		1
1(d)(iii)	repeat **or** take average	allow compare with another students results	1
Total			**9**

4.4.2.4 The pH scale and neutralisation

Answer 06 · Mark scheme

June 2010 | CHY3F | Original Q1 | Legacy

CHY3F

4.4.2.4 The pH scale and neutralisation

Answer 07 · Mark scheme

Question 3

question	answers	extra information	mark
3(a)(i)	hydrogen		1
3(a)(ii)	partially		1
3(b)(i)	same size / mass / amount / length of magnesium (ribbon) **or** same concentration of acids	allow react for same time ignore repeats ignore volume / amount of acid	1
3(b)(ii)	bubbles / gas given off **or** magnesium disappears / dissolves / reacts slower with ethanoic acid **or** faster with hydrochloric acid		1 1
3(c)(i)	titration	allow titration identified in box if answer line blank	1
3(c)(ii)	burette		1
3(c)(iii)	(indicator) changed colour	allow solution changes colour but not vinegar ignore specific colours	1
Total			8

4.4.2.4 The pH scale and neutralisation

Answer 07 · Mark scheme

January 2011 | CHY3F | Original Q3 | Legacy

CHY3F

4.4.2.4 The pH scale and neutralisation

Answer 08 · Mark scheme

June 2011 | CHY3F | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)(i)	sodium hydroxide solution blue		1 1
3(a)(ii)	barium chloride white		1 1
3(b)	fully ionised in water		1
3(c)(i)	H^+ ions		1
3(c)(ii)	lower than		1
3(d)(i)	(indicator) changed colour / goes colourless	ignore clear / discoloured	1
3(d)(ii)	13.9 **or** (titration) 2		1
3(d)(iii)	13.2	ecf from 3(d)(ii)	1
Total			**10**

4.4.2.4 The pH scale and neutralisation

Answer 08 · Mark scheme

June 2011 | CHY3F | Original Q3 | Legacy

CHY3F

4.4.2.4 The pH scale and neutralisation

Answer 09 · Mark scheme

June 2012 | CH2FP | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 2, and apply a 'best-fit' approach to the marking.		6

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	There is a simple description of a laboratory procedure for obtaining potassium chloride.	There is a clear description of a laboratory procedure for obtaining potassium chloride from potassium hydroxide solution and hydrochloric acid that does not necessarily allow the procedure to be completed successfully by another person. The answer must include the use of an indicator or a method of obtaining crystals.	There is a detailed description of a laboratory procedure for obtaining potassium chloride from potassium hydroxide solution and hydrochloric acid that can be followed by another person. The answer must include the use of an indicator and a method of obtaining crystals

examples of the chemistry points made in the response:

- One reagent in beaker (or similar)
- Add (any named) indicator
- Add other reagent
- Swirl or mix
- Add dropwise near end point
- Stop addition at change of indicator colour
- Note volume of reagent added
- Repeat without indicator, adding same volume of reagent **or** remove indicator using charcoal
- Pour solution into basin / dish
- Heat (using Bunsen burner)
- Leave to crystallise / leave for water to evaporate / boil off water

Accept any answers based on titration

Question 7 continues on the next page . .

CH2FP

Question 7 cont'd..

question	answers	extra information	mark
7(b)	nitric (acid)	allow HNO_3 ignore incorrect formula	1
7(c)(i)	because it is a fertiliser / helps plants grow	allow plant food do **not** accept pesticide / herbicide / neutralising soil	1
7(c)(ii)	tick by: 'Should farmers stop using ammonium nitrate on their land?' any **two** from: • cannot be done by experiment • based on opinion / view • ethical **or** economic issue	 accept difficult to get / not enough evidence allow must be done by survey if top box ticked allow **1** mark for drinking water varies from place to place	1 2
Total			**11**

UMS Conversion Calculator www.aqa.org.uk/umsconversion

4.4.2.4 The pH scale and neutralisation

Answer 10 · Mark scheme

January 2013 | CH2FP | Original Q5 | Legacy

question	answers	extra information	mark
5(a)(i)	sulfuric		1
5(a)(ii)	1		1
5(a)(iii)	to speed up the reaction		1
5(b)	because copper oxide in excess **or** because acid all used up / neutralised	allow copper oxide unreacted	1
5(c)	evaporation **or** crystallisation	allow heating allow cooling allow leave (to evaporate) do **not** accept freezing	1
5(d)	Some copper sulfate may have been lost during the experiment		1
Total			**6**

4.4.2.4 The pH scale and neutralisation

Answer 10 · Mark scheme

January 2013

CH2FP

4.4.2.4 The pH scale and neutralisation

Answer 11 · Mark scheme

question	answers	extra information	mark
8(a)(i)	because they are positively charged	accept they are positive / H^+ accept oppositely charged **or** opposites attract ignore they are attracted	1
8(a)(ii)	gains one / an electron	accept $H^+ + e^- \rightarrow H$ or multiples allow gains electrons	1
8(b)	3 bonding pairs 1 lone pair	 accept 2 non-bonding electrons on outer shell of nitrogen	1 1
8(c)(i)	hydroxide / OH^-	do **not** accept sodium hydroxide	1
8(c)(ii)	$H^+ + OH^- \rightarrow H_2O$	ignore state symbols ignore word equation	1

January 2013

CH2FP

question	answers	extra information	mark
8(d)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5.		6

0 marks	**Level 1 (1-2 marks)**	**Level 2 (3-4 marks)**	**Level 3 (5-6 marks)**
No relevant content.	There are basic descriptions of advantages or disadvantages of the electrolysis cells.	There are clear descriptions of environmental or economic advantages or disadvantages of the electrolysis cells. Comparisons may be implied.	There are detailed descriptions of environmental and economic advantages and disadvantages, comparing the electrolysis cells.

examples of chemistry points made in the response:

Accept converse where appropriate.

- mercury cell is more expensive to construct
- mercury is recycled but membranes must be replaced
- mercury is toxic but membrane / polymer is not
- removing traces of mercury from waste is expensive
- mercury cell uses more electricity
- mercury cell produces chlorine that is purer
- mercury cell produces higher concentration / better quality of sodium hydroxide (solution)

Total			**12**

UMS conversion calculator www.aqa.org.uk/umsconversion

4.4.2.4 The pH scale and neutralisation

Answer 12 · Mark scheme June 2013 | CH2FP | Original Q2 | Legacy

Question 2

question	answers	extra information	Mark
2(a)	11		1
2(b)(i)	nitric		1
2(b)(ii)	neutralisation		1
2(c)	fertiliser	accept helps plants grow accept provide nitrogen	1
2(d)(i)	nitrate iodide	must be in this order	1 1
2(d)(ii)	precipitate		1
2(d)(iii)	filtration/filtering		1
2(d)(iv)	crystallisation	allow evaporation / heat / cooling do **not** accept freezing ignore “leave it” if unqualified	1
Total			**9**

4.4.2.4 The pH scale and neutralisation

Answer 13 · Mark scheme June 2014 | CH2FP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
4(a)(i)	14		1	2 / 2.3.1c	G
4(a)(ii)	isotope		1	1 / 2.3.1d	G
4(a)(iii)	(very) small	*accept smaller / tiny / (very) little*	1	1 / 2.3.1b	G
4(b)(i)	C		1	1 / 2.1	A
4(b)(ii)	NH_3		1	1 / 2.1.1g	A
4(c)(i)	nitric (acid)		1	1 / 2.6.2b	G
4(c)(ii)	indicator		1	1 / 2.6.1b	E
4(c)(iii)	crystallisation **or** evaporation	allow by heating **or** cooling **or** leave (on windowsill) *do not accept freezing*	1	1 / 2.6.1c	E
4(c)(iv)	any **one** from: • grass grows faster • grass grows taller **or** thicker	*allow grass grows better / greener*	1	3 / 2.6.2c	E
4(d)	potassium (atom) loses (an electron) chlorine (atom) gains (an electron) 1 (electron) electron	reference to incorrect bonding or particle = max **3** ignore references to full outer shells	1 1 1 1	1 + 2 / 2.1.1c/d/e	E
Total			**13**		

4.4.2.4 The pH scale and neutralisation

Answer 13 · Mark scheme

June 2014 | CH2FP | Original Q4 | Legacy



4.4.2.4 The pH scale and neutralisation

Answer 14 · Mark scheme June 2014 | CH2FP | Original Q6 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
6(a)(i)	(phosphoric) acid	*allow phosphoric*	1	2 / 2.6.2d	G
6(a)(ii)	H^+ / hydrogen (ion)	*if ion symbol given, charge must be correct*	1	2 / 2.6.2d	E
6(b)(i)	pencil so it will not run / smudge / *dissolve* **or** because ink would run / smudge / *dissolve*	 *ignore pencil will not interfere with / affect the results* *ignore ink will interfere with / affect the results*	1 1	2 / 2.3.2b	E
6(b)(ii)	any **three** from: • *3* colours in Cola • *2* colours in Fruit drink • one of the colours is the same • two of the colours in Cola are different • one of the colours in Fruit drink is different • *one of the colours in Cola is the most soluble*	*reference to spots / dots = max **2*** *allow colouring for colour* *allow more colours in cola **or** fewer colours in fruit drink* *allow some of the colours in the drinks are different* *accept one of the colours in Cola has the highest R_f value*	3	3 / 2.3.2b	E
6(c)	different substances travel at different speeds **or** have different retention times	*accept different attraction to solid* *ignore properties of compounds*	1	1 / 2.3.2c	E

4.4.2.4 The pH scale and neutralisation

Answer 14 · Mark scheme

June 2014 | CH2FP | Original Q6 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
6(d)(i)	Is there caffeine in a certain brand of drink?		1	3 / 2.3.2	A
6(d)(ii)	any **two** from: • cannot be done by experiment • based on opinion / *lifestyle choice* • ethical, *social* or economic issue	*accept caffeine has different effects on different people*	2	3 / 2.3.2	E
Total			**11**		

4.4.2.4 The pH scale and neutralisation

Answer 14 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
7 Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.				1 + 2 / 2.1.1f/g 2.2.1a 2.2.2a	E

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content	*There is a statement about the bonding and/or structure **or** melting / boiling point of chlorine **or** sodium chloride.*	*There are statements about the bonding and/or structure of chlorine **or** sodium chloride.*	*There are statements about the bonding and/or structure of chlorine **and** sodium chloride.* *There is an explanation of why chlorine is a gas **or** sodium chloride is a solid.*

Examples of chemistry points made in response:

Chlorine:

covalent bonds between atoms

forming (simple) molecules

no / weak attraction / bonds between molecules

low boiling point

Sodium chloride:

*ionic bonds **or** electrostatic attraction*

strong bonds

in all directions

between oppositely charged ions

forming giant lattice

large amounts of energy needed to break bonds

high melting point

Total			6

4.4.2.4 The pH scale and neutralisation

Answer 15 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)(i)	(calcium) carbonate	ignore $CaCO_3$	1	1 / 1.2.1a
5(a)(ii)	(thermal) decomposition		1	1 / 1.2.1b
5(a)(iii)	water	allow H_2O allow hydrogen oxide	1	1 / 1.2.1d
5(a)(iv)	alkali	allow base	1	1 / 1.2.1d
5(b)(i)	straight line through the first, second and fourth points straight line through the last four points	 allow a straight line through the last three points if the first straight line extrapolates below point four	1 1	2+3 / 1.2.1g
5(b)(ii)	repeat the experiment (at each mass of aggregate) (use the results to) calculate a mean / average value (for each mass of aggregate)	do not allow repeat at other masses	1 1	3 / 1.2.1g

4.4.2.4 The pH scale and neutralisation

Answer 15 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(b)(iii)	line drawn to y axis showing extrapolation		1	2+3 / 1.2.1g
	correct value read from graph	allow +/- one small square do not allow 0 award 1 mark for a value of 34-40 if no extrapolation shown	1	
5(b)(iv)	at first, the force needed to break a concrete beam increases	allow values allow at first the statement is correct	1	3 / 1.2.1g
	but the force needed to break a concrete beam then decreases	allow values	1	
	mention of 400 g as the point at which the force needed changes or value from graph	allow 400g if there is no intercept on graph	1	
Total			**13**	

4.4.2.4 The pH scale and neutralisation

Answer 15 · Mark scheme

June 2015 | CH1FP | Original Q5 | Legacy



4.4.2.4 The pH scale and neutralisation

Answer 16 · Mark scheme

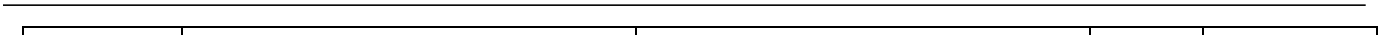
June 2015 | CH3FP | Original Q7 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)(i)	(19.5 + 18.5 + 19.0)/3	allow (23.0 +19.5 + 18.5 + 19.0)/4 for **1** mark	2	**AO2/ AO3** 3.4.1.g
7(a)(ii)	R P Q	allow Q P R for **1** mark	2	**AO3** 3.4.1.g
7(b)	any **two** from: • repeat more times • calculate a mean • measure to one decimal place		2	**AO3** 3.4.1.g
7(c)	both students get similar results / similar pattern		1	**AO3** 3.4.1.g
Total			**7**	

4.4.2.4 The pH scale and neutralisation

Answer 16 · Mark scheme

June 2015 | CH3FP | Original Q7 | Legacy



4.4.2.4 The pH scale and neutralisation

Answer 17 · Mark scheme

June 2016 | CH2FP | Original Q6 | Legacy

Question	Answers	Extra information	Mark	AO / SpecRef
6(a)	endothermic		1	AO1 2.5.1d
6(b)	82 (%)	correct answer with working gains **3** marks if 17 or 34 not shown in working **max 2** marks accept 82.4 accept 82.35 to full calculator display (82.35294...) correctly rounded to at least 2 sf if no answer or incorrect answer, then (M_r =) 17 gains **1** mark **or** 14/17 gains **2** marks **OR** ($2M_r$ =) 34 gains **1** mark **or** 28/34 gains **2** marks **OR** 14/their M_r shown gains **1** mark **or** correct calculation of 14/their M_r gains **2** marks	3	AO2 2.3.3a, 2.3.1f
6(c)(i)	7 / seven		1	AO1 2.6.2d
6(c)(ii)	$H^+ + OH^- \rightarrow H_2O$		1	AO1 2.6.2e
6(c)(iii)	ammonium chloride	allow NH_4Cl ignore an incorrect formula	1	AO1 2.6.2b

Question 6 continues on the next page

Question 6 continued

Question	Answers	Extra information	Mark	AO / SpecRef
6(d)			6	2AO2 / 4AO3 2.6.2c

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content.	Suggestion with a reference to a graph.	Suggestion with reasons referring to more than one graph.	Suggestion with reasons from all three graphs, and linking of ideas which may explain a compromise.

Examples of chemistry points made in response:

A reasonable suggested amount of fertiliser would be in the region of 200 kg (per ha). Accept any suggestion from about 180 kg (per ha) to 500 kg (per ha).

Yield:

- Using fertiliser improves yield.
- Yield improved most up to about 200 kg (per ha) of fertiliser.
- Yield only increased slightly above about 200 kg (per ha).

Profit:

- About 200 kg of fertiliser gives the most profit.
- Above about 200 kg (per ha) of fertiliser profit declines.

Run off:

- Run off is at low levels until about 300 kg (per ha) of fertiliser.
- Above about 300 kg (per ha) of fertiliser, run off increases.

Examples of linking of ideas:

- Overall 200 kg gives high crop yield and most profit.
- In conclusion 200 kg gives high crop yield and low run off.
- 200 kg gives most profit and low run off.

Examples of compromise:

- Profits go down after about 200 kg (per ha) of fertiliser because cost of fertiliser is not covered by increased yield.
- 200 kg gives the highest profit although it is not the highest yield.
- 500 kg gives the best yield but has the most runoff.

Total			13

4.4.2.4 The pH scale and neutralisation

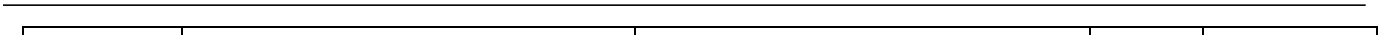
Answer 18 · Mark scheme June 2017 | CH2FP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1 (a)(i)	the ink would run / smudge / smear	accept converse	1	**AO1** 2.3.2b
1 (a)(ii)	below		1	**AO1** 2.3.2b
1 (a)(iii)	any **two** from: • contains red • does not contain blue • contains two other colours • contains three colours in total	do **not** accept contains red and blue	2	**AO3** 2.3.2b
1(b)(i)	separated		1	**AO1** 2.3.2c
1(b)(ii)	6/six		1	**AO2** 2.3.2c
1(b)(iii)	any **one** from: • accurate • sensitive • rapid / fast • small sample.	do **not** accept more precise do **not** accept more reliable	1	**AO1** 2.3.2a
Total			**7**	

4.4.2.4 The pH scale and neutralisation

Answer 18 · Mark scheme

June 2017 | CH2FP | Original Q1 | Legacy



4.4.2.4 The pH scale and neutralisation

Answer 19 · Mark scheme

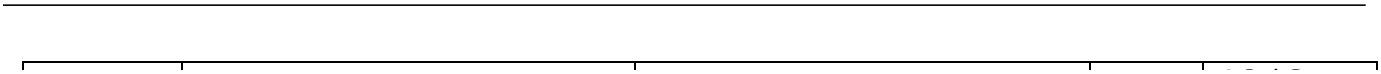
June 2017 | CH2FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)(i)	s		1	**AO2** 2.6.1a
2(a)(ii)	to speed up the reaction		1	**AO2** 2.6.1b
2(a)(iii)	tick (✓) by: 1		1	**AO1** 2.6.2d
2(a)(iv)	tick (✓) by: To make sure all the sulfuric acid has reacted		1	**AO1** 2.6.1b
2(b)(i)	funnel	accept filter funnel	1	**AO1** 2.6.1b
2(b)(ii)	heat / evaporate / boil	accept cool accept leave (to evaporate) do **not** accept heat until all water gone	1	**AO1** 2.6.1b
2(c)	tick (✓) by: The student left some copper sulfate crystals in the apparatus.		1	**AO3** 2.3.3d
2(d)(i)	white	accept grey	1	**AO1** 2.5.1d
2(d)(ii)	it goes blue	accept steam / water vapour ignore unspecified colour change	1	**AO1** 2.5.1d
2(e)(i)	polymers		1	**AO1** 2.2.5a
2(e)(ii)	as wealth decreases, ethene production decreases	accept converse	1	**AO2** 2.6; 3.7.12
2(e)(iii)	no relationship		1	**AO2** 2.6; 3.7.12
Total			**12**	

4.4.2.4 The pH scale and neutralisation

Answer 19 · Mark scheme

June 2017 | CH2FP | Original Q2 | Legacy



Answer 20 · Mark scheme

June 2018 | 8462/1F | Original Q7

The full source mark scheme begins on page 62. Follow original question 7 in that document.

4.4.2.4 The pH scale and neutralisation

Answer 21 · Mark scheme

June 2019 | 8462/1F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	H^+		1	AO1 4.4.2.4
09.2	hydrochloric (acid) water	allow HCl allow H_2O	1 1	AO2 4.4.2.2
09.3	burette	do **not** accept biuret	1	AO1 4.4.2.5
09.4	27.6 (cm^3)	allow 27.60 (cm^3)	1	AO2 4.4.2.5

Question 9 continued

Question	Answers	Mark	AO/ Spec. Ref
09.5	**Level 3**: The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO3 AO1
	Level 2: The design/plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3–4	AO1 x 2
	Level 1: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	AO1 x 2
	No relevant content	0	
	Indicative content allow converse using acid added to alkali Key steps • measure the volume of acid • add indicator to the acid • add sodium hydroxide solution • until the colour changes • record volume of sodium hydroxide solution added • repeat procedure with the other acid Use of results • compare the two volumes of sodium hydroxide solution to find which sample **P** or **Q** is more concentrated Other points • pipette to measure volume of acid • use a few drops of indicator • swirl • use a white tile • rough titration to find approximate end point • add dropwise near the endpoint • read volume from bottom of meniscus • repeat and take a mean		4.4.2.5

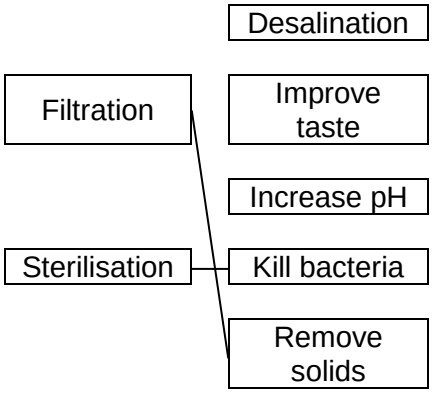
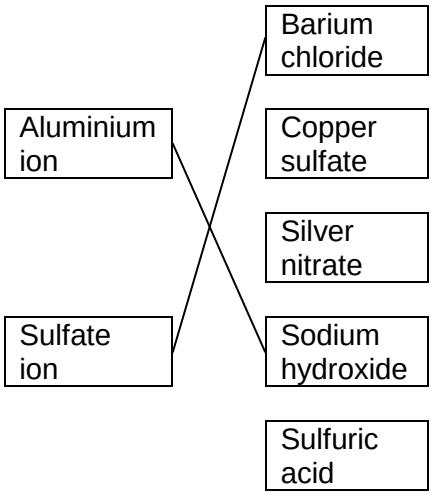
Total			**11**

4.4.2.4 The pH scale and neutralisation

Answer 22 · Mark scheme

June 2019 | 8462/2F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1		an extra line from a step to a reason for that step negates that mark	1 1	AO1 4.10.1.2
01.2	chlorine ozone		1 1	AO1 4.10.1.2
01.3	evaporate all water from the sample measure the sample's boiling point		1 1	AO2 4.8.1.1 4.10.1.2
01.4		an extra line from an ion to a compound needed negates that mark	1 1	AO1 4.8.3.2 4.8.3.5
01.5	distillation		1	AO1 4.10.1.2
Total			9	

4.4.2.4 The pH scale and neutralisation

Answer 23 · Mark scheme

November 2020 | 8462/1F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	nitric acid		1	AO2 4.4.2.2 RPA 1
07.2	zinc oxide		1	AO2 4.4.2.2 RPA 1
07.3	magnesium bromide		1	AO2 4.1.1.1
07.4		allow a tolerance of 1 cm^3 on volumes allow a tolerance of 0.2 on pH values		AO2 4.4.2.4
	(from 0) to 20 cm^3 the pH increases (gradually)	allow increase from pH 1 to pH 3	1	
	at 20 cm^3 the pH changes from pH 3 to pH 11	allow sudden / steep increase at 20 cm^3 allow sudden / steep increase from pH 3 to pH 11	1	
	from 20 cm^3 the pH increases (gradually)	allow (gradual) increase from pH 11 if no other marks awarded allow **1** mark for a description of the three stages with no values used.	1	

Answer 23 · Mark scheme

Question 7 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	20 (cm^3)	allow 20.0 (cm^3)	1	AO3 4.4.2.4
07.6	red		1	AO3 4.4.2.4
07.7	$\frac{0.06}{25(.0)} \times 100$ = 0.24 (%)		1 1	AO2 4.4.2.5
07.8	(pipette) measures volume more accurately **or** (pipette has a) smaller (percentage) uncertainty	allow (pipette is) more accurate	1	AO3 4.4.2.5 RPA 2
Total			**11**	

4.4.2.4 The pH scale and neutralisation

Answer 24 · Mark scheme

November 2021 | 8462/1F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	H^+		1	AO1 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	neutralisation		1	AO1 4.4.2.2 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	$H_2SO_4 + 2\,KOH \rightarrow K_2SO_4 + 2\,H_2O$	allow multiples	1	AO2 4.1.1.1 4.4.2.2 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	14		1	AO1 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	pipette		1	AO3 4.4.2.5 RPA2

4.4.2.4 The pH scale and neutralisation

Question 5 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	add potassium hydroxide (solution) to the (conical) flask add (a few drops of) indicator add the (sulfuric) acid (from the burette) until the colour (of the indicator) changes read the volume from the burette		1 1 1 1 1	AO1 4.4.2.5 RPA2

Total			**10**

4.4.2.4 The pH scale and neutralisation

Answer 25 · Mark scheme

November 2021 | 8462/2F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	(mass) balance (volume) measuring cylinder	allow scales allow burette / pipette	1 1	AO1 4.10.1.2 RPA 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	(mass of salt = 30.49 – 30.44 =) 0.05 (g salt) (mass of salt in 1000 cm^3 =) $\frac{1000}{50}$ × 0.05 = 1.0 (g) **alternative approach**: (volume ratio = $\frac{1000}{50}$) = 20 (1) (mass of salt in 1000 cm^3) = (30.49 – 30.44) × 20 (1) = 1.0 (g) (1)	allow correct use of incorrectly determined mass of salt allow correct use of incorrectly determined volume ratio	1 1 1	AO2 4.10.1.2 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	heat the evaporating dish and salt again measure the mass of the evaporating dish and salt again		1 1	AO3 4.10.1.2 RPA 8

4.4.2.4 The pH scale and neutralisation

Question 2 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	(no condenser) (more) steam escapes **or** less steam condenses	allow converse for condenser allow water vapour for steam	1	AO1
	(because) cooling / condensing is less efficient **or** (because) a (liebig) condenser is not used	allow (because) cooling / condensing is slower allow (because) cold water is not used for cooling / condensing	1	AO3 4.1.1.2 4.10.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	(distilled) water is pure	allow microbes are destroyed (by distillation)	1	AO3 4.8.1.1 4.10.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	using chlorine using ozone		1 1	AO1 4.10.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	pH 7		1	AO2 4.4.2.4 4.10.1.2 RPA8

Total			13

4.4.2.4 The pH scale and neutralisation

Answer 26 · Mark scheme

June 2022 | 8462/1F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	B		1	AO3 4.4.1.2

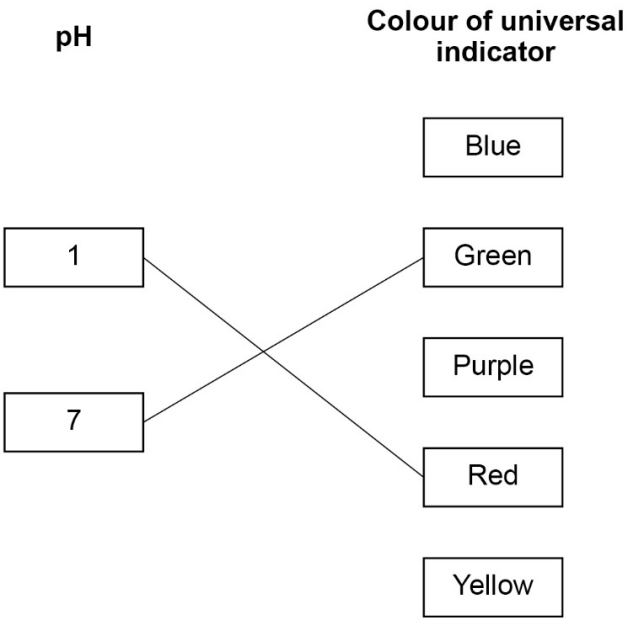
Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	C		1	AO3 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	zinc (oxide) sulfuric (acid)	allow ZnO allow H_2SO_4	1 1	AO2 4.4.2.2

4.4.2.4 The pH scale and neutralisation

Answer 26 · Mark scheme

June 2022 | 8462/1F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	 do **not** accept more than one line from a box on the left		1 1	AO1 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	neutralisation		1	AO1 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	burette		1	AO1 4.4.2.5 RPA2

Total Question 3		**8**

4.4.2.4 The pH scale and neutralisation

Answer 27 · Mark scheme

June 2022 | 8462/2F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	100 7	must be in this order	1 1	AO1 4.8.1.1 4.10.1.2 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	pH probe / meter **or** universal indicator (paper / solution)	allow wide range indicator (paper / solution)	1	AO1 4.10.1.2 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	balance measuring cylinder		1 1	AO1 4.10.1.2 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	(mean =) $\frac{1.73 + 1.70 + 1.75 + 1.78}{4}$ = 1.74 (g)		1 1	AO2 4.10.1.2 RPA8

4.4.2.4 The pH scale and neutralisation

Answer 27 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	(mass =) $\frac{1.5 \times 1000}{50}$ = 30 (g)		1 1	AO2 4.10.1.2 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	yellow		1	AO1 4.8.3.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	white		1	AO1 4.8.3.4 RPA7

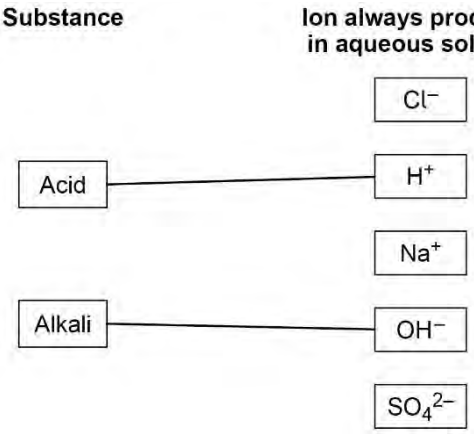
Total Question 1		**11**

4.4.2.4 The pH scale and neutralisation

Answer 28 · Mark scheme

June 2023 | 8462/1F | Original Q2

Question 2

Question	Answers	Mark	AO / Spec. Ref.
02.1	 do **not** accept more than **one** line from a box on the left	1 1	AO1 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	alkaline		1	AO1 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	pipette		1	AO1 4.4.2.5 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	burette		1	AO1 4.4.2.5 RPA2

4.4.2.4 The pH scale and neutralisation

Answer 28 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	trial 3		1	AO3 4.4.2.5 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	any **one** from: • (hydrochloric acid) not added drop by drop • did not swirl • did not rinse apparatus (after previous trial) • did not use a white tile • misread pipette / burette	allow measured out too much alkali	1	AO3 4.4.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	$\left(25.0\ cm^3 = \frac{25.0}{1000} =\right)\ 0.025\ (dm^3)$		1	AO2 4.3.2.5
	(mass =) 0.025 × 4.00	allow correct use of incorrect / no conversion of volume	1	
	= 0.1 (g)		1	
	alternative approach:			
	$\left(\text{concentration} = \frac{4.00}{1000} =\right)$ $0.004\ (g/cm^3)$ (1)			
	(mass =) 0.004 × 25.0 (1)	allow correct use of incorrectly determined concentration in g/cm^3		
	= 0.1 (g) (1)			

Total Question 2	10

4.4.2.4 The pH scale and neutralisation

Answer 29 · Mark scheme

June 2024 | 8462/1F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	(**A**) pipette (**B**) conical flask (**C**) burette		1 1 1	AO1 4.4.2.5 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	methyl orange (solution) **or** phenolphthalein (solution)	allow litmus (solution) do **not** accept universal indicator	1	AO1 4.4.2.5 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	colour change	ignore clear	1	AO1 4.4.2.5 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	any **two** from: • swirl • add the acid drop by drop • read (burette) at eye level • ensure no bubbles in burette • use a white tile • repeat **and** take a mean	allow read (burette) at the bottom of the meniscus	2	AO1 4.4.2.5 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	16.6 cm^3		1	AO2 4.4.2.5 RPA2

4.4.2.4 The pH scale and neutralisation

Answer 29 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	trial 2 and trial 3		1	AO3 4.4.2.5 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	$BaCl_2$		1	AO2 4.1.1.1 4.4.2.2

Total Question 2	**10**

4.4.2.4 The pH scale and neutralisation

Answer 30 · Mark scheme

June 2024 | 8462/1F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	(similarity) both have one outer (shell) electron	allow energy level for shell allow same number of outer (shell) electrons	1	AO1 4.1.2.1
	(difference) sodium has 3 shells but potassium has 4 shells	allow potassium has more shells allow (different) number of shells	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	any **two** from: • effervescence / bubbles / fizzing • (potassium) floats • (potassium) moves around • (potassium) becomes smaller • (potassium) melts • flame • explosion	ignore gas produced allow (potassium) forms a ball ignore colour of flame	2	AO1 4.1.2.5 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	blue / violet / purple		1	AO2
	(the solution is) alkaline	allow (the solution) contains OH^- (ions) allow (the solution) contains hydroxide ions allow the solution is basic	1	AO1 4.1.2.5 4.4.2.4

4.4.2.4 The pH scale and neutralisation

Answer 30 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	all five points correctly plotted	allow a tolerance of ± ½ a small square allow **1** mark for three or four points correctly plotted	2	AO2 4.1.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	3.4 (mg/cm^3)	allow a value in the range 3.0 to 3.8 (mg/cm^3)	1	AO3 4.1.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	chlorine and potassium bromide		1	AO2 4.1.2.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.7	relative molecular mass increases and boiling point increases		1	AO1 4.1.2.6

Total Question 9	**11**

4.4.2.4 The pH scale and neutralisation

Answer 31 · Mark scheme

June 2024 | 8462/2F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	alloy reinforcement		1 1	AO1 AO2 4.10.3.2 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	burning (of methane) releases carbon dioxide decomposition (of limestone) releases carbon dioxide	allow burning methane ignore methane is a greenhouse gas allow decomposition of limestone	1 1	AO2 4.9.2.2 4.9.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	hydrochloric acid limewater		1 1	AO1 4.8.3.3 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	 (pre-stressed concrete) can bear the weight of (heavy) traffic (because pre-stressed concrete is) stronger	allow converse for plain concrete allow (pre-stressed concrete) bridge is less likely to collapse do **not** accept (because pre-stressed concrete is) more dense	 1 1	AO3 4.10.3.3

4.4.2.4 The pH scale and neutralisation

Answer 31 · Mark scheme

June 2024 | 8462/2F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	any **two** from: (plain concrete slabs) • are cheaper • will be lighter (to transport / lay) • do not need to carry vehicles	allow converse for pre-stressed concrete	2	AO3 4.10.3.3

Total Question 7	10

4.4.2.4 The pH scale and neutralisation

Answer 32 · Mark scheme

June 2025 | 8462/1F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	titration		1	AO1 4.4.2.5 RPA 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	indicator	allow any named indicator	1	AO1 4.4.2.5 RPA 2

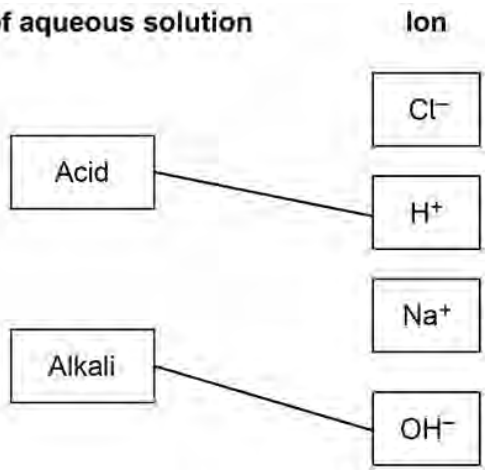
Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	burette		1	AO1 4.4.2.5 RPA 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	add the acid dropwise (near the end point) **or** swirl the flask		1	AO3 4.4.2.5 RPA 2

4.4.2.4 The pH scale and neutralisation

Answer 32 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	use of 8.95, 9.00 and 8.85 **only**		1	AO3
	(mean volume =) $\frac{8.95 + 9.00 + 8.85}{3}$	allow (mean volume =) $\frac{26.80}{3}$ allow correct use of incorrect values of volume	1	AO2
	= 8.933333 (cm^3)		1	AO2
	= 8.93 (cm^3)	allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses the values in the question	1	AO2 4.4.2.5 RPA 2

Question	Answers	Mark	AO / Spec. Ref.
04.6	 do **not** accept more than one line from a box on the left	1 1	AO1 4.4.2.4

Total Question 4	10

4.4.2.4 The pH scale and neutralisation

AQA

GCSE
CHEMISTRY

8462/1F - PAPER 1 FOUNDATION TIER

Mark scheme

8462

June 2018

Version/Stage: 1.0 Final

4.4.2.4 The pH scale and neutralisation

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system.

[2 marks]

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. Full marks can, however, be given for a correct numerical answer, without any working shown.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ecf in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

3.10 Do not accept

Do **not** accept means that this is a wrong answer which, even if the correct answer is given as well, will still mean that the mark is not awarded.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- Level of response mark schemes are broken down into levels, each of which has a descriptor.
- The descriptor for the level shows the average performance for the level.
- There are two marks in each level.

Before you apply the mark scheme to a student's answer, read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1: Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 content.

Step 2: Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this.

The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

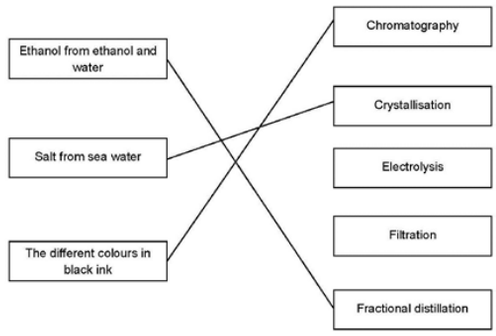
Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do **not** have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

An answer which contains nothing of relevance to the question must be awarded no marks.

4.4.2.4 The pH scale and neutralisation

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1			1 1 1	AO1 4.1.1.2
01.2	include a (filter) funnel	allow funnel drawn on the diagram ignore clamp stand	1	AO3 4.1.1.2
01.3	evaporate condense	must be this order	1 1	AO1 4.1.1.2
01.4	$\frac{2}{20} \times 100$ = 10 (%)	an answer of 10 (%) scores **2** marks an answer of 11.1(%) **or** 90 (%) scores **1** mark	1 1	AO2 4.2.2.7
01.5	an alloy		1	AO1 4.2.2.7
01.6	the layers in the mixture are distorted		1	AO1 4.2.2.7

4.4.2.4 The pH scale and neutralisation

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	8000 nm^3		1	AO2 4.2.4.1
Total			**11**	

4.4.2.4 The pH scale and neutralisation

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	7		1	AO1 4.1.2.6
02.2	small molecule		1	AO2 4.1.2.6 4.2.2.4
02.3	F_2		1	AO1 4.1.1.1 4.1.2.6
02.4	the reactivity decreases (going down Group 7) (because) chlorine displaces bromine and iodine (and) bromine displaces iodine **or** iodine does not react	allow the reactivity decreases from chlorine to iodine allow (because) chlorine has two reactions allow (because) neither bromine nor iodine can displace chlorine allow (and) bromine has one reaction **or** iodine has no reactions allow (and) iodine cannot displace bromine	1 1 1	AO1 4.1.2.6 AO3 4.1.2.6 AO3 4.1.2.6
02.5	80		1	AO2 4.3.1.2

4.4.2.4 The pH scale and neutralisation

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	(1.2 kg =) 1200 (g) **or** (900 g =) 0.9 (kg)	an answer of 75 (%) scores **2** marks	1	AO2 4.3.3.1
	$(\frac{900}{1200} \times 100) = 75(\%)$ **or** $(\frac{0.9}{1.2} \times 100) = 75(\%)$	allow an answer correctly calculated from: $(\frac{900}{\text{incorrect attempt at conversion of 1.2}} \times 100)$ **or** $(\frac{\text{incorrect attempt at conversion of 900}}{1.2} \times 100)$	1	
Total			**9**	

4.4.2.4 The pH scale and neutralisation

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	nucleus neutron neutron electron proton	must be in this order	1 1 1 1 1	AO1 4.1.1.3 4.1.1.4 4.1.1.5
03.2	$(A_r)\ \frac{(63 \times 70) + (65 \times 30)}{100}$ = 63.6	an answer of 63.6 scores **2** marks	1 1	AO2 4.1.1.6
03.3	copper / Cu	allow ecf from answer to question **03.2**	1	AO2 4.1.1.1
03.4	$\frac{1.2 \times 10^{-10}}{10\,000}$ **or** $1.2 \times 10^{-10} \times 1 \times 10^{-4}$ $= 1.2 \times 10^{-14}$ (m)	an answer of 1.2×10^{-14} (m) scores **2** marks a correct answer not in standard form scores **1** mark	1 1	AO2 4.1.1.5
Total			**10**	

4.4.2.4 The pH scale and neutralisation

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	3.6 (cm^3)		1	AO2 4.4.3.4
04.2	hydrogen line only		1	AO3 4.4.3.4
04.3	both lines		1	AO3 4.4.3.4
04.4	graphite has delocalised electrons		1	AO1 4.2.3.2
04.5	**cathode** zinc (1) **anode** chlorine (1) hydrogen (1) bromine (1)	do **not** accept chloride allow **1** mark if chlorine and zinc the wrong way around do **not** accept bromide allow **1** mark if bromine and hydrogen the wrong way around	1+1 1+1	AO2 4.4.3.2 4.4.3.4
Total			**8**	

4.4.2.4 The pH scale and neutralisation

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	gas		1	AO1 4.2.2.2
05.2	the gas escapes	allow carbon dioxide escapes do **not** accept references to evaporation	1	AO1 4.3.1.3
05.3	5.12 (g)		1	AO2 4.3.1.3
05.4	4.00 (g) trial 1	allow 2.89 written in either space, or ringed in the table, unless contradicted by mass of copper carbonate or trial number	1	AO3 4.3.1.3
05.5	reheat (and reweigh) until constant mass	 an answer of heat to constant mass scores **2** marks if no other mark scored allow for **1** mark heat for longer **or** (heat at a) higher temperature **alternative approach**: (1) continue heating and pass gas through limewater (1) until the (lime)water stops bubbling **or** until the limewater no longer turns cloudy	1 1	AO3 4.3.1.3

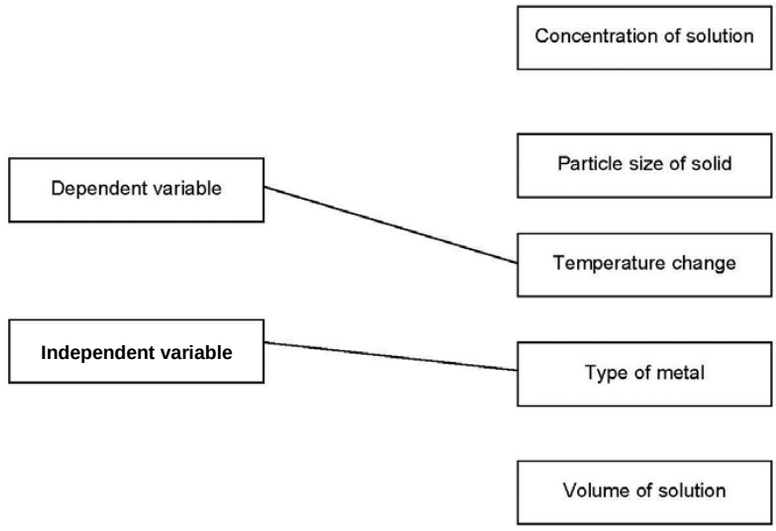
4.4.2.4 The pH scale and neutralisation

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	straight line of best fit	must touch at least 5 of the 6 plots	1	AO2 4.3.1.3
05.7	correct value read from line of best fit in Figure 8	allow tolerance of ± ½ small square	1	AO2 4.3.1.3
05.8	(mass =) $168 \times \frac{\text{answer from question } \mathbf{05.7}}{8.4}$	a correctly calculated value from their answer to question **05.7** scores **2** marks allow (mass =) answer from question **05.7** × 20	1	AO2 4.3.1.3
	correctly calculated value (g)		1	
Total			**10**	

4.4.2.4 The pH scale and neutralisation

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	 allow **one** mark if answers are reversed		1 1	AO1 4.5.1.1
06.2	polystyrene is a better insulator		1	AO3 4.5.1.1
06.3	both bars labelled both bars correctly plotted	 allow tolerance of ± ½ small square ignore width and spacing of bars if no other mark scored, allow **1** mark for any one bar correctly plotted and labelled	1 1	AO2 4.5.1.1

4.4.2.4 The pH scale and neutralisation

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	temperature increases **or** temperature does not decrease	ignore because it is exothermic allow (because) energy / 'heat' is transferred to the surroundings energy / 'heat' is not taken in from the surroundings allow the energy of the products is less than the energy of the reactants	1	AO3 4.5.1.1
06.5	(most reactive) magnesium (zinc) nickel	this order only	1	AO3 4.5.1.1 4.4.1.2
06.6	suitable method described the observations / measurements required to place in order an indication of how results would be used to place the unknown metal in the reactivity series **approaches that could be used:** **approach 1:** add the unknown metal to copper sulfate solution (1) measure temperature change (1) place the metals in order of temperature change (1)		1 1 1	AO3 4.4.1.2 4.5.1.1

4.4.2.4 The pH scale and neutralisation

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6 cont.	**approach 2:** add the metal to salt solutions of the other metals **or** heat the metal with oxides of the other metals (1) measure temperature change (only if salt solutions used) **or** observe whether a chemical change occurs (1) compare temperature change or whether there is a reaction to place in correct order (1) **approach 3:** add all of the metals to an acid (1) measure temperature change or means of comparing rate of reaction (1) place the metals in order of temperature change or rate of reaction (1) **approach 4:** set up electrochemical cells with the unknown metal as one electrode and each of the other metals as the other electrode (1) measure the voltage of the cell (1) place the metals in order of voltage (1)			
06.7	D		1	AO1 4.5.1.2
06.8	C		1	AO1 4.5.1.2
Total			**12**	

4.4.2.4 The pH scale and neutralisation

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	sodium oxide	allow Na_2O	1	AO2 4.1.1.1 4.1.2.5 4.4.1.1
07.2	oxidation		1	AO1 4.4.1.1
07.3	13		1	AO1 4.4.2.4
07.4	sodium hydroxide		1	AO2 4.1.1.1
07.5	OH^-		1	AO1 4.4.2.4
07.6	(volume =) $\frac{250}{1000}$ or ¼ or 0.25 (dm^3) **or** (mass per cm^3 =) $\frac{40}{1000}$ (g) or 0.04 (g) ($\frac{250}{1000}$ × 40 =) 10 (g)	an answer of 10 (g) scores **2** marks	1 1	AO2 4.3.2.5

4.4.2.4 The pH scale and neutralisation

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.7	all points correct	allow a tolerance of ± ½ a small square allow **1** mark for 3 points correct ignore any attempt at a line of best fit	2	AO2 4.1.2.5
07.8	39 (°C)	allow any value from 34 to 46 (°C)	1	AO2 4.1.2.5
Total			**10**	

4.4.2.4 The pH scale and neutralisation

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	any **one** from: • metal • (metal) hydroxide • (metal) carbonate • alkali	allow named example allow correct formula ignore base allow ammonium hydroxide allow ammonium carbonate allow soluble base allow ammonia	1	AO1 4.4.2.1 4.4.2.2 4.4.2.3
08.2	$Ca(NO_3)_2$	allow $Ca^{2+}(NO_3^-)_2$	1	AO2 4.4.2.2

4.4.2.4 The pH scale and neutralisation

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Mark	AO / Spec. Ref.
01.3	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 4.4.2.3
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content • use magnesium oxide and sulfuric acid • add sulfuric acid to a beaker • warm sulfuric acid • add magnesium oxide • stir • continue adding until magnesium oxide is in excess • filter • using a filter paper and funnel • to remove excess magnesium oxide • heat solution in an evaporating basin • to crystallisation point • leave to crystallise • pat dry with filter paper credit may be given for diagrams		
Total		**8**	

4.4.2.4 The pH scale and neutralisation

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	FeS_2	do **not** accept equations	1	AO2 4.2.1.3
09.2	26 30 26	must be this order	1 1 1	AO2 4.1.1.4 4.1.1.5
09.3	any **two** from: • iron has a high(er) melting / boiling point • iron is dense(r) • iron is hard(er) • iron is strong(er) • iron is less reactive • iron has ions with different charges • iron forms coloured compounds • iron can be a catalyst	allow the converse statements for sodium allow transition metal for iron allow Group 1 metal for sodium ignore references to atomic structure ignore iron rusts allow iron is less malleable / ductile allow specific reactions showing difference in reactivity allow iron is magnetic	2	AO1 4.1.2.5 4.1.3.1 4.1.3.2

4.4.2.4 The pH scale and neutralisation

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	carbon is more reactive (than nickel)	allow converse	1	AO1 4.4.1.2 4.4.1.3
	(so) carbon will displace / replace nickel (from nickel oxide) **or** (so) carbon will remove oxygen (from nickel oxide)	allow (so) nickel ions gain electrons allow (so) carbon transfers electrons to nickel (ions)	1	
09.5		an answer of 67.8 (%) scores **3** marks an answer of 67.8160919 (%) or correctly rounded answer to 2, 4 or more sig figs scores **2** marks an incorrect answer for one step does **not** prevent allocation of marks for subsequent steps		AO2 4.3.3.2
	(total M_r of reactants =) 87		1	
	(percentage atom economy) $= \frac{59}{87} \times 100$	allow (percentage atom economy) $= \frac{59}{\text{incorrectly calculated } M_r} \times 100$	1	
	= 67.8 (%)	allow an answer from an incorrect calculation to 3 sig figs	1	
Total			**11**	

4.4.2.4 The pH scale and neutralisation

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	copper, zinc, sodium chloride solution		1	AO2 4.5.2.1
10.2	a reactant is used up	allow the reaction stops allow electrolyte / electrode / ions / metal / metal hydroxide / alkali for reactant	1	AO1 4.5.2.1
10.3	the reaction is not reversible		1	AO1 4.5.2.1
10.4	$2H_2 + O_2 \rightarrow 2H_2O$	allow fractions / multiples allow **1** mark for O_2	2	AO1 AO2 4.1.1.1 4.5.2.2

4.4.2.4 The pH scale and neutralisation

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

<table>
<tr><th>Question</th><th>Answers</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td rowspan="5">10.5</td><td>Level 3: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.</td><td>5–6</td><td>AO3</td></tr>
<tr><td>Level 2: Some logically linked reasons are given. There may also be a simple judgement.</td><td>3–4</td><td>AO3</td></tr>
<tr><td>Level 1: Relevant points are made. This is not logically linked.</td><td>1–2</td><td>AO2</td></tr>
<tr><td>No relevant content</td><td>0</td><td></td></tr>
<tr><td>Indicative content

reasons why fuel cells could be judged as better
<table>
<tr><th>from the table</th><th>from other knowledge</th></tr>
<tr><td>• time for refuelling a fuel cell is faster than recharging
or
a fuel cell does not need to be recharged
• a fuel cell has a greater range</td><td>• hydrogen can be renewable if made by electrolysis using renewable energy
• lithium-ion batteries can catch fire
• produces only water
or
no pollutants produced
• lithium-ion batteries may release toxic chemicals on disposal
• lithium-ion batteries (eventually cannot be recharged so) have a finite life</td></tr>
</table>
reasons why the lithium-ion battery could be judged as better
<table>
<tr><th>from the table</th><th>from other knowledge</th></tr>
<tr><td>• lithium-ion uses energy more efficiently
• cost of lithium-ion car much less
• cost of recharging much less than refuelling with hydrogen</td><td>• hydrogen is often made from fossil fuels so is not renewable
• charging points are more widely available than hydrogen filling stations
• hydrogen takes up a lot of space
or
is difficult to store
• hydrogen can be highly flammable / explosive
• no emissions produced
• (catalyst in the hydrogen fuel-cell eventually becomes poisoned so) have a finite life</td></tr>
</table></td><td></td><td>4.4.3.4
4.5.2.1
4.5.2.2</td></tr>
<tr><td>Total</td><td></td><td></td><td>11</td></tr>
</table>

4.4.2.4 The pH scale and neutralisation

Answer 20 · Examiner comments

June 2018 | 8462/1F | Original Q7

Question 7 (low and standard demand)

07.1 This question was answered well with 80% of students giving the correct name of the product. Some students tried to add in other products such as water or hydrogen.

07.2 85% of students knew this was an oxidation reaction.

07.3 68% of students could relate the colour of the universal indicator to the correct pH. The most common distractor was 'pH 7'.

07.4 73% of students could name sodium hydroxide correctly.

Answer 20 · Examiner comments

June 2018 | 8462/1F | Original Q7

07.5 This question assessed recall directly from the specification. 43% of students could identify the OH^- ion as being present in all alkalis.

More than a 25% thought that the Na^+ ion was responsible, with nearly as many opting for the H^+ ion.

07.6 Students found this calculation very difficult, with 7% achieving full marks. 13% of students made no attempt to answer.

It was necessary to convert either the volume to dm^3 or the concentration to mol/cm^3 to gain partial credit, but most students either failed to attempt a conversion or did not know how many cm^3 are in one dm^3.

07.7 58% of students achieved both marks. It was very common to see the scale on the *x*-axis misread so that the plots for sodium and potassium were incorrect. Some students were using a pen or a very thick pencil so were unable to correct their answer or were compromising accuracy.

07.8 This question was answered very well, with 82% of students answering correctly.

Answer 21 · Examiner comments

June 2019 | 8462/1F | Original Q9

Question 9 (standard demand)

09.1 Approximately 50% of students correctly identified H^+ as the ion produced by all acids in aqueous solution.

The most common incorrect response was OH^-

09.2 Approximately 15% of students scored both marks for completing the word equation.

The correct answers 'hydrochloric' (acid) and 'water' were seen in approximately equal numbers.

Common incorrect responses included:

- chloric / chlorine (for the reactant)
- hydrogen (for the product).

09.3 The name 'burette' was not well known with only approximately a third of students scoring the mark. Phonetic equivalents of this word also scored the mark but not 'biuret' (as this is a reagent used in biology).

Common incorrect responses included:

- thermometer
- pipette

Answer 21 · Examiner comments

June 2019 | 8462/1F | Original Q9

- syringe
- measuring cylinder.

09.4 Approximately 50% of students were able to take a correct reading from the burette scale.

The most common incorrect answer was 28.4 cm^3.

09.5 Even though this extended response question drew on their experience of a required practical activity, approximately 20% of students did not attempt it. A similar proportion scored 0 marks.

Approximately 10% of students achieved a Level 3 mark.

In many cases, at least one of the key steps in this titration was omitted, which therefore meant that students were not able to access Level 3.

4.4.2.4 The pH scale and neutralisation

Answer 26 · Examiner comments June 2022 | 8462/1F | Original Q3

Question 3 (Low and standard demand)

03.1 This question was answered correctly by the majority of students, who recognised that copper would not react. Incorrect responses were almost equally divided between **A** and **D**.

03.2 This question was answered correctly by nearly all students.

03.3 Fewer than half of students scored both marks, although three quarters named one substance correctly. Most students realised that the appropriate metal oxide would be zinc oxide. However, fewer could correctly name the acid, with hydrochloric acid being a popular response.

03.4 Nearly three-quarters of students scored at least one mark, with nearly half scoring both.

03.5 Nearly 80% of students identified the correct type of reaction.

03.6 Over 80% of students correctly identified the apparatus as a burette. The majority of the rest gave a response of pipette.

Answer 27 · Examiner comments June 2022 | 8462/2F | Original Q1

Question 1 (Low demand)

01.1 Around 70% of the students gained 2 marks. The boiling point of pure water was slightly better known than its pH.

01.2 Under half of the students gained this mark, with universal indicator being the most common correct answer and pH scale the most common incorrect response.

01.3 Around 70% of the students gained two marks. Use of a thermometer was the most common incorrect response.

01.4 Very well answered, with nearly 90% of the students gaining both of the marks. the majority both obtaining the correct answer and showing their working.

01.5 This was also very well answered, with more than three-quarters of the students scoring both marks.

01.6 Nearly 50% of the students gained a mark for knowing the flame colour of sodium is yellow.

01.7 Knowing that the halide ion test produces a white precipitate gained a mark for over 50% of the students.

4.4.2.4 The pH scale and neutralisation

Answer 28 · Examiner comments June 2023 | 8462/1F | Original Q2

Question 2 (low and standard demand)

02.1 Students found this question difficult, with only a fifth of students gaining both marks.

02.2 Three quarters of students knew that the solution would be alkaline.

02.3 Students found this question difficult, with two thirds of students selecting a beaker as a piece of equipment suitable for measuring 25.0 cm^3 of a solution. Students seemed unfamiliar with the use of a pipette to measure volumes accurately.

02.4 This was well answered, with the vast majority recognising a burette as the correct piece of equipment.

02.5 Nearly all students recognised Trial 3 as the anomalous result.

02.6 This question proved difficult, with only a quarter of students scoring the mark. Many concentrated on why Trial 3 was chosen, rather than a source of the inaccuracy. Those who did try to find a source of inaccuracy were often successful, with the acid not being added dropwise or too much sodium hydroxide being measured out, being the most popular answers.

02.7 Two thirds of students scored no marks on this question. Those who attempted to use the information given to convert their volume to dm^3 often scored at least two marks. There were many answers where the figures 1000, 4 and 25 had been manipulated almost at random; 160 was a common response.

Answer 29 · Examiner comments

Question 2 (low and standard demand)

02.1 Over half of students named all three pieces of equipment correctly, with three quarters scoring at least two marks. The burette was often called a measuring cylinder, and the conical flask a beaker. The burette and pipette were sometimes reversed.

02.2 Students found this difficult – many gave names of acids or alkalis, or substances totally unrelated such as iodine. Of those who did give an indicator, many gave universal indicator, which is not suitable for a titration. The most common correctly named indicator was phenolphthalein; any reasonable attempt at the spelling was accepted.

02.3 This was answered well, with nearly two thirds of students giving 'colour change' or a description of one. 'Clear' is not a description of a colour so was insufficient for a mark.

02.4 A third of students scored one mark, but far fewer scored both. Many students did not realise that they had been given the correct apparatus, and merely had to say what they would do to use that apparatus accurately. Instead, most suggested using other, less accurate, equipment such as a measuring cylinder or a beaker. The most common correct answer was to add the acid drop by drop. A few suggested repeating the experiment, without also saying to take a mean of the results. Some students suggested using a measuring cylinder to measure acid into the burette, not understanding what a burette does.

02.5 Two thirds of students gave the correct reading. The most common distractor was 17.4 cm^3.

02.6 Three quarters of students identified the closest pair of results.

02.7 Students found this standard demand question difficult. Just over a third of students identified the formula of barium chloride, but the distractor Ba_2Cl was even more popular.

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4.4.2.4 The pH scale and neutralisation

Answer 30 · Examiner comments — June 2024 | 8462/1F | Original Q9

Question 9 (standard demand)

09.1 This question discriminated well, with one in six students scoring both marks and more than two fifths scoring at least one. Many students did not read the question fully and gave similarities and differences in properties rather than electronic structures. These responses gained no credit. Of those who did reference the electronic structure, most stated correctly that both have one electron on the outer shell, but were less successful in giving a correct difference. Sometimes the wrong number of shells was given for the two elements: usually 2 shells for sodium and 3 for potassium. Some stated that potassium has more outer shells than sodium. This is not correct as the phrase 'outer shell' is always taken to mean the single outermost shell.

09.2 More than a third of students could give two correct observations, and more than four fifths could give one, with bubbling, floating and a flame being the most popular. 'Gas produced' did not gain credit as it is not an observation but a deduction from the observation of bubbling. 'Fizzing' is taken to mean effervescence, so fizzing and bubbling are the same thing rather than two different observations. Credit was not given for any observation requiring extra equipment such as a thermometer or an indicator.

09.3 Only two fifths of students could give a correct colour and even fewer could express the reason in terms of the solution being alkaline; many thought it would be neutral. Some students gave purple as the colour, but gave potassium burning with a purple flame as their reason.

09.4 Nearly three fifths of students scored both marks for plotting the data, with the vast majority scoring at least one. The most commonly mis-plotted point was (86, 9.1) which was often plotted at (92, 9.1). There was no expectation that a line of best fit would be drawn.

09.5 Students were good at estimating the missing value, with nearly three quarters scoring the mark. Sometimes incorrect and inappropriate methods were seen which produced values in the allowed range, such as averaging all five values, or finding the difference between the points adjacent to the missing one. These were not given credit.

09.6 Over a third of students identified the reagents. There was an even distribution of incorrect responses.

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Answer 30 · Examiner comments — June 2024 | 8462/1F | Original Q9

09.7 Two fifths of students identified the correct pair of trends. The most popular error was to identify that the boiling point decreases down the group.

4.4.2.4 The pH scale and neutralisation

Answer 31 · Examiner comments June 2024 | 8462/2F | Original Q7

Question 7 (low and standard demand)

07.1 Approximately two out of five students gained both marks with a one in two gaining one mark. It is important that students read the question carefully as there was a significant number of students who ticked one box instead of two.

07.2 This question asked for two ways in which a greenhouse gas is released in the process described. Less than 25% of students gained both marks with just over 35% more gaining one mark. Incorrect or insufficient responses included 'heating the limestone' and general references to the equation, or that methane might escape during its combustion.

07.3 The carbonate test is poorly understood with less than 15% of students correctly identifying the substance added to the limestone and the test for carbon dioxide. Two in five students gained one mark. The most frequent incorrect response was to mistakenly identify the test as universal indicator.

07.4 Less than 35% of students gained one mark in this question, with less than 15% gaining two marks. Responses which did not gain credit included those referring to carrying heavy weights in general rather than the weight being from lorries or vehicles, responses in terms of the incorrect property from the table or failing to make a valid comparison.

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07.5 This question proved to be easier than that for the concrete bridge with over 50% of students gaining one mark and over 35% gaining both marks. Responses which did not gain credit again included those that failed to make a valid comparison or those that simply quoted data from the table.

4.4.2.4 The pH scale and neutralisation

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Question 4 (low and standard demand)

04.1 Nearly three quarters chose the correct answer. Distillation was a very popular distractor.

04.2 Fewer than a third of students realised that the substance should be an indicator or were able to name one. Universal indicator was the most popular named indicator; this was accepted although it is not really appropriate for a titration. Acid and alkali were popular incorrect responses, as was liquid.

04.3 About five sixths of students chose burette as the correct answer.

04.4 Only two fifths of students realised that the acid should be added dropwise and / or that the solution should be swirled. One popular misconception was that the addition should be timed. Stirring was not accepted as an alternative to swirling, but adding the acid slowly was accepted as an alternative to dropwise or drop by drop.

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04.5 Most students knew how to calculate a mean, and the majority could round to 3 significant figures. However, some thought that 9.00, rather than 8.45, was the anomalous result; students need to look beyond the first digit. Quite a few placed a dot over the 3 in 8.93 of their final answer, indicating a recurring decimal, which was therefore an infinite number of significant figures not 3. Over two thirds of students scored at least 3 marks, with two fifths scoring full marks.

04.6 Only a quarter of students could identify both ions correctly. The ion present in an acid was known more often than the ion in an alkali. Many knew the correct two ions but had them the wrong way round. A significant number identified the ions in sodium chloride rather than in an acid and an alkali.